Fire-related germination cues for soil-stored seedbanks of fire-prone habitats in the Sydney region, Australia

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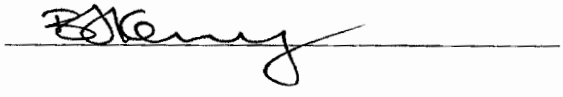
CERTIFICATE OF AUTHORSHIP / ORIGINALITY

I certify that this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.



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ABSTRACT

Approximately 89% of species in fire-prone vegetation types of the Sydney region are assumed to have a soil seedbank. While a post-fire germination pulse is common for such species, the mechanisms involved in fire-related dormancy breaking are known for very few species in the region other than legumes.

The effects of the fire-related germination cues provided by soil heating and combustion products (smoke and charred wood) have been studied on numerous plant taxa in several regions of the world. However, these different cues have rarely been studied in combination.

The general aim of this thesis was to investigate the effect of fire-related germination cues on a variety of soil seedbank species of the Sydney region. This involved exploring methods of laboratory application of three fire-related cues (heat, smoke, and charred wood); assessing the individual and interactive effects of these cues on germination response (dormancy breaking) in laboratory, glasshouse and field trials; and examination of how these cues are received by soil-stored seeds.

Charred wood was found to have little effect on the germination of studied species, though the effects were very sensitive to the method of charred wood application. While half of the species studied were found to have a smoke cue, few of these responded to smoke only. Most species with only a smoke cue were sensitive to high temperatures (heat treatment was lethal or inhibitory).

One quarter of species had a heat cue only, most of these possessing a hard seed coat. A number of species without hard seed coats were also found to respond positively to heat, though these species also responded to smoke. The greatest proportion of studied species fell into the category of having germination stimulated by both heat and smoke. Among these species there was an even division into species with an equal germination response to both cues, an additive effect when the two cues are applied simultaneously, and a response only when the two cues are applied together.

The consequences of the different germination responses found are discussed in terms of the range of fire conditions likely to stimulate recruitment. Relationships were sought between functional types (fire response and seed traits) and these germination responses in order to explain the recruitment outcome of different fire regimes. It was found that the species showing a germination response that would allow germination under the widest range of fire conditions were those for which seedling recruitment is most critical after each fire event.